LINE INTERFACE, MODE 1 (LI-1), 628050

GENERAL DESCRIPTION

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1. GENERAL

1.01 This Section provides a general description of the ITT D448 line interface, Mode 1 (LI-1), 628050 (Fig. 1), to the functional block diagram level.

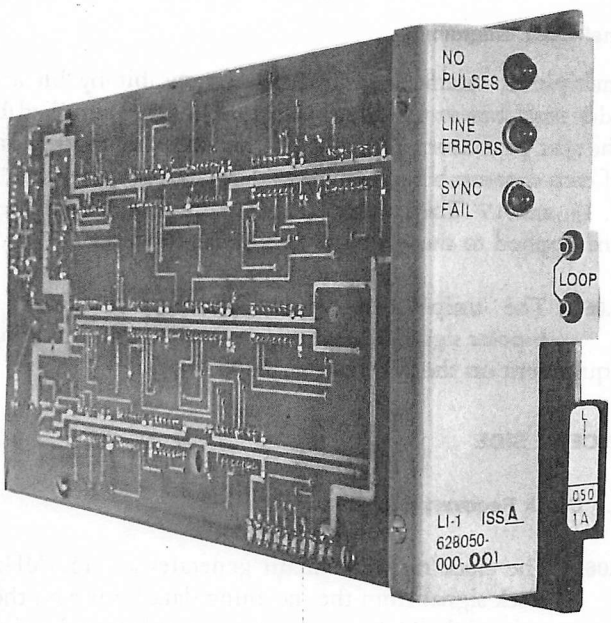

Fig. 1—LI-1, 628050

1.02 Whenever this Section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The LI-1 multiplexes and demultiplexes the data from the two digroups of the D448 terminal, adds stuff bits, and interfaces the terminal to T1C line termination equipment.

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (common equipment mounting section) in connector J8C. Installation procedures for the unit are provided in Section ITTR-18-431.

2.02 The unit is available in Group -0 only.

2.03 The unit consists of two epoxy-glass printed circuit boards (PCBs), associated circuit components, and a front panel. The lower front edge of one PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (LI-1), last three digits of the model number, last three digits of the part number, and issue letter. The unit mnemonic, part number, and issue letter are also located on the front panel.

2.04 The LINE ERRORS, SYNC FAIL, and NO PULSES LEDs and the LOOP test points are located on the front panel.

2.05 Printed circuit wiring is etched on both sides of each PCB. The PCBs are interconnected by a 10-pin connector. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the right PCB. These contacts mate with a 70-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 2)

TRANSMIT SIDE

A. Clock Generation and Control

3.01 Clock for the transmit side of the LI-1 can either be generated by the clock generator or provided from the office interface unit (OIU). When the OIU sets the $\overline{\text{SELECT}}$ lead low, clock from the OIU on the TCL1544L lead is selected to be the clock signal for the transmit side. When the $\overline{\text{SELECT}}$ lead is set high, the clock generator provides a 3.152-MHz crystal-controlled clock.

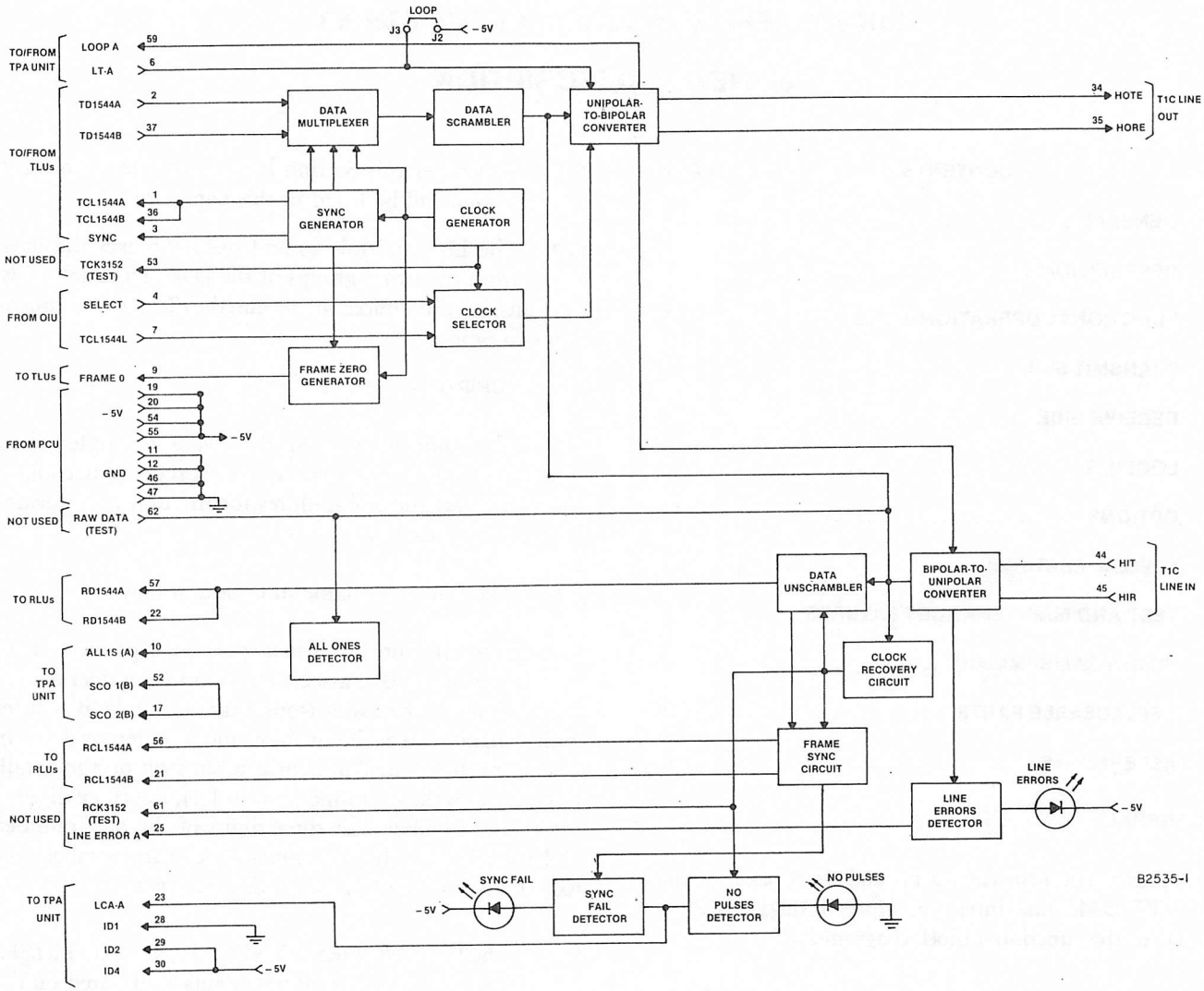

Fig. 2—LI-1, 628050, Functional Block Diagram

3.02 The clock applied to the sync generator is used to control application of stuff bits to the data multiplexer and the state of those stuff bits. The stuff bits are generated in the pattern 1100. The sync generator also provides 1.544-MHz clock to each digroup's transmit logic unit (TLU). The 1.544-MHz clock is derived from the 3.152-MHz clock. The sync generator provides a signal on the $\overline{\text{SYNC}}$ lead which synchronizes each TLUs clock divider to be in frame sync with the LI-1.

3.03 The clock applied to the frame zero generator is used to provide a signal on the $\overline{\text{FRAME 0}}$ lead to each TLU which identifies the beginning of each superframe (12 frames) and synchronizes the TLU framing circuit to be in superframe sync with the LI-1.

B. Data Transmission

3.04 The transmit bit stream from each digroup's TLU is applied to the data multiplexer. The data multiplexer interleaves these bit streams bit by bit and adds stuff bits to the data. The stuff bits are supplied by the sync generator. The stuff bits are added in every frame of each digroup bit stream preceding channel time slots 1, 7, 13, and 19. The combined bit stream is then scrambled and applied to the unipolar-to-bipolar converter.

3.05 The unipolar-to-bipolar converter provides a bipolar signal at ± 6V to the T1C line termination equipment on the HOTE and HORE leads.

RECEIVE SIDE

A. Clock Recovery and Framing

3.06 The clock recovery circuit generates a 3.152-MHz clock signal from the incoming data for use on the receive side of the LI-1. If the clock is ever lost, indicating the incoming data has been lost, the no pulses detector turns on the NO PULSES LED and signals the trunk pro-

cessor and alarm (TPA) unit on the $\overline{\text{LCA-A}}$ lead to cause a carrier group alarm (CGA).

3.07 One of the functions of the frame sync circuit is to generate a 1.544-MHz clock from the 3.152-MHz clock of the clock recovery circuit. The 1.544-MHz clock is sent to each digroup's receive logic unit (RLU).

3.08 The frame sync circuit synchronizes the operation of the receive side to the alternating 1/0 pattern of the terminal framing bits. If the frame sync circuit loses synchronization, it signals the sync fail detector. The sync fail detector turns on the SYNC FAIL LED and signals the TPA unit on the $\overline{\text{LCA-A}}$ lead to cause a CGA.

3.09 The frame sync circuit does not synchronize to the stuff bits. However, it does keep track of them. During the occurrence of a stuff bit, the frame sync circuit stops the clock to the RLUs so that the stuff bits are not clocked into the RLUs.

B. Data Transmission

3.10 Incoming data from the T1C line termination equipment is converted to unipolar and monitored for bipolar violations. If a bipolar violation occurs, the LINE ERRORS LED is turned on momentarily. The LED is turned on constantly if solid bipolar violations are occurring.

3.11 The all ones detector checks the input data for the presence of all 1s. If such a condition is detected, the $\overline{\text{ALL1S(A)}}$ lead to the TPA unit is set low to cause a remote alarm.

3.12 The unipolar output of the bipolar-to-unipolar converter is unscrambled and applied to the RLUs on the RD1544A and RD1544B leads. The data is demultiplexed into the separate digroups at each RLU by the clock signal from the frame sync circuit. The clocks for each RLU are 180 degrees out-of-phase with each other, and since the RLU only accepts data during the positive transition of the clock, the RLU only accepts every other data bit applied to it.

LOOPING

3.13 Looping of the terminal can be accomplished by either pressing the LOOP button on the TPA unit during a CGA condition or by inserting a shorting plug into the LOOP test points on the front panel of the unit. When the terminal is looped, the output of the data scrambler is applied to the input of the data unscrambler. A signal from the unipolar-to-bipolar converter inhibits the operation of the bipolar-to-unipolar converter. Additionally, the unipolar-to-bipolar converter sends an all 1s bit stream to the T1C line termination equipment. This causes the far-end terminal to detect a remote alarm condition.

4. OPTIONS

4.01 This unit has no field-selectable options.

5. SPECIAL FEATURES

5.01 If the LI-1 is removed from the multiplex shelf while the terminal is in service, a local alarm will occur. The SCO loop on the unit is fed to the TPA unit. If that loop opens, the TPA unit causes a local alarm.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
LINE ERRORS LED (red)	DS1	Indicates bipolar violations being received from incoming T1C line; cannot be turned on during looped conditions.
SYNC FAIL LED (red)	DS2	Indicates failure of LI-1 to synchronize to receive data bit stream.
NO PULSES LED (red)	DS3	Indicates that no data being received by LI-1 from incoming T1C line.
LOOP test points	J2 and J3	Provides a means of looping the terminal when the terminal is not in trunk processing.

6.02 The looping initiated at the TPA unit requires that the terminal be in a CGA condition, and while looped the CGA condition cannot be cleared. The alternate looping method provided by the LOOP test points is called the LI- loop. This LI- loop, initiated by the insertion of a shorting plug in the LOOP test points, does not necessitate a CGA condition as opposed to the terminal

looping. The intent of the LI- loop is to provide for "hot-standby" operation between system installation and final system turn-up, should that be an extended period of time. During LI- loop, the alarm reporting is active and all channel unit signaling highways are available for testing purposes.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage Current	−5.0 ±0.25 Vdc 1045 mA maximum, 575 mA nominal
T1C LINE OUTPUT	
Line Rate Line Code Output Impedance Pulse Characteristics Base-to-Peak Height Width Maximum Rise and Fall Time	3.152 Mb/s ±30 ppm Bipolar 100 ohms nominal ±6.0 ±0.6V 160 ±20 ns 20 ns
T1C LINE INPUT	
Line Rate Line Code Input Impedance Pulse Characteristics Width Base-to-Peak Height	3.152 Mb/s ±30 ppm Bipolar 100 ohms nominal 130 ns minimum ±1.5V minimum
OPERATING ENVIRONMENT	
Temperature Humidity Altitude	0° to 55°C To 95% at 40°C (no condensation) To 14,000 ft (4,267 m)

TABLE B (CONT)

ITEM	SPECIFICATION
DIMENSIONS	
Height Width Depth	5.0 in. (12.7 cm) 1.8 in. (4.6 cm) 9.6 in. (24.4 cm)
WEIGHT	1.5 lb (0.7 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly Schematic	628050-000 628050-002

9.02 Related information on the LI-1 may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf, (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 — General Description	ITTR-18-005
Mode 1 Common Equipment — Installation and Pretest	ITTR-18-431